Cosmic Frontier Experiment Status

March 31, 2014

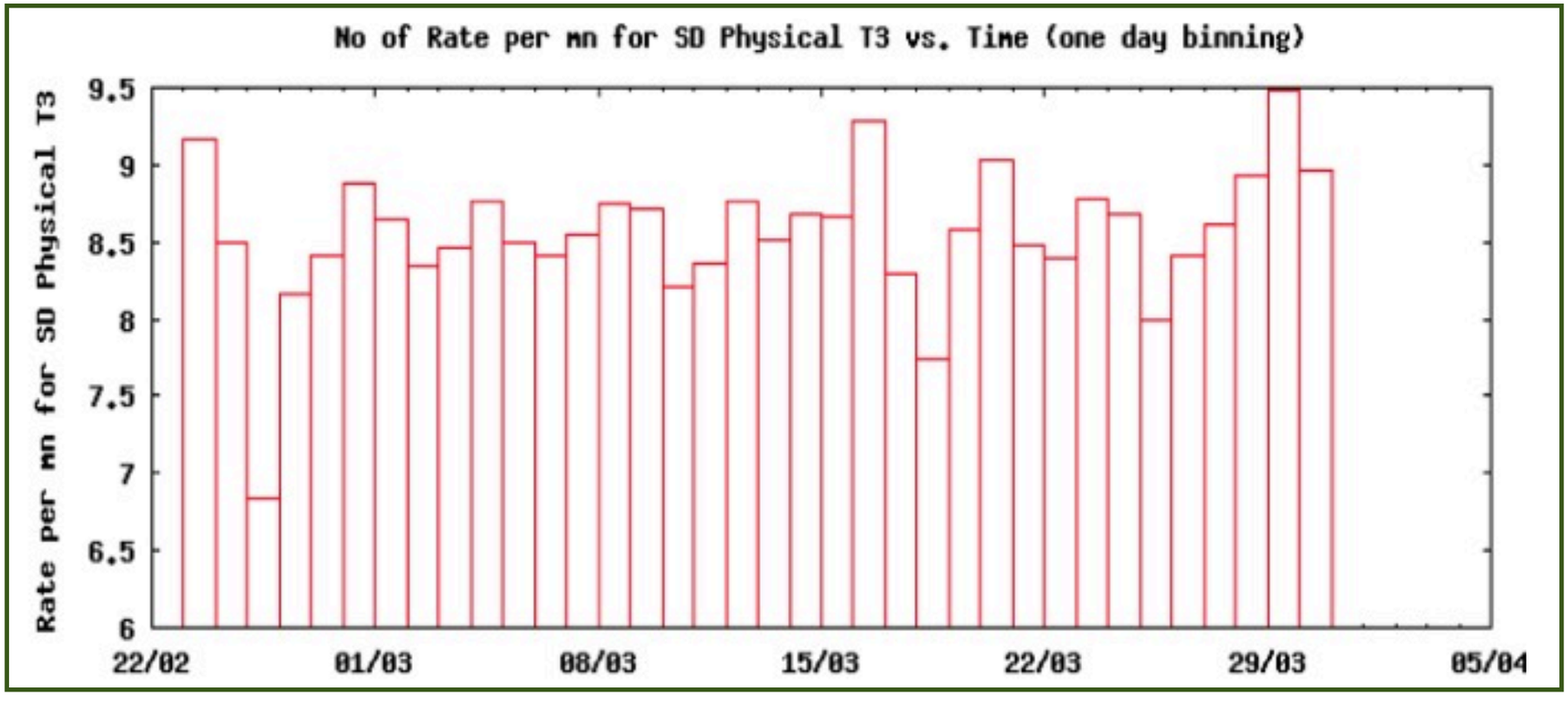
Experiment	Location	Status	Start of operations	Nominal end of operations	Physics
SuperCDMS	Soudan	Operating	Mar 2012	Mar 2015?	Dark Matter
COUPP/PICO 2L	SNOLAB	Operating	Dec 2013	Dec 2014?	Dark Matter
COUPP/PICO 60	SNOLAB	Operating	June 2013	Dec 2015?	Dark Matter
Darkside 50	LNGS (Gran Sasso)	Operating/ Calibrating	Jan 2014	Dec 2016?	Dark Matter
DAMIC	SNOLAB	Operating	Dec 2012	Dec 2015	Dark Matter
Dark Energy Survey	CTIO, Chile	Operating	Sep 2013	Feb 2018	Dark Energy
Pierre Auger	Argentina	Operating	2008	2015 (for FNAL)?	High Energy Cosmic Rays
Holometer	Meson Lab	Commissioning	Spring 2014	2015	Spacetime

Pierre Auger Observatory

Activities of the past month/two weeks

- SD efficiency: 96% efficiency in the past two weeks on-going maintenance, upgrade R&D activity (involves SD) in the field.
- Recent FD observation period: - Feb 23 - March 10; no error, smooth running.
  - current shift is running; March 23 - April 9.
- Radio array (AERA) is now running:
  - quadruple hybrid event (FD + SD + AMIGA + AERA).
- Collaboration meeting at the Observatory (Malargüe), March 9-14.
- Upgrade and International Scientific Advisory Committee meeting held at Malargüe, March 7-9.
- 1 new full-authored publication in March.

AERA butterfly antenna



Feb 22-Mar 31

Number of triggers from cosmic rays ($E > 10^{18}$ eV) per minute ~ 12000 / day

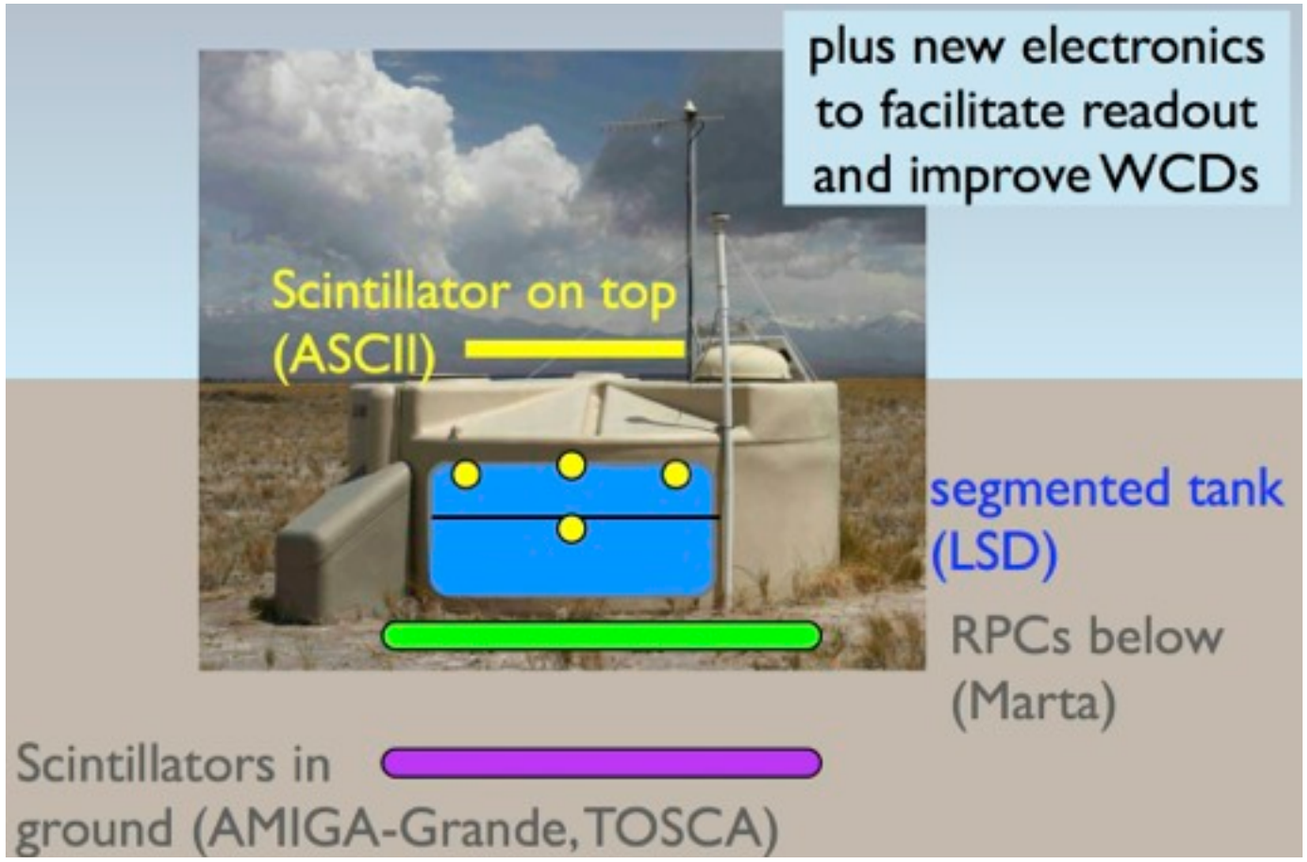
Pierre Auger Observatory

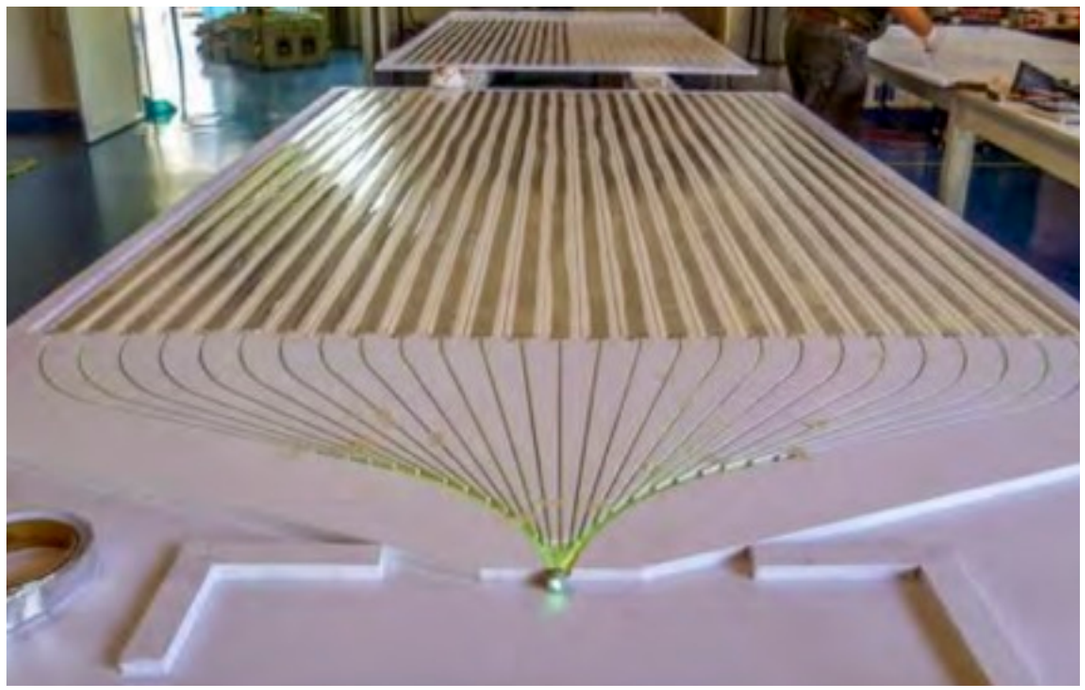
Upgrade for beyond 2015

- Elucidate origin of flux suppression;
  (is it really the GZK suppression??)
- How much proton at highest energies?
- Probe hadronic interaction E_{CM} > 70 TeV
  ➡ better composition determination via better muon counting

1) Upgrade aging SD electronics for faster sampling and better event reconstruction.
2) Install new detector on SDs for better muon-sensitivity;

Examples of upgrade options





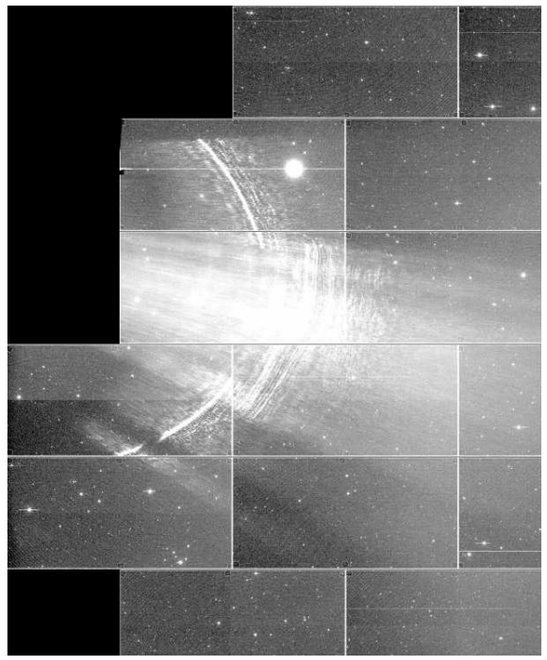
- Several options in consideration
- Case presented to the International Scientific Advisory Committee in March 2014 to evaluate its scientific merit
  ➡ strongly supports the Auger upgrade science

Assembling prototype scintillator detectors (ASCII) using Fermilab's Minos scintillation bars

Dark Energy Survey

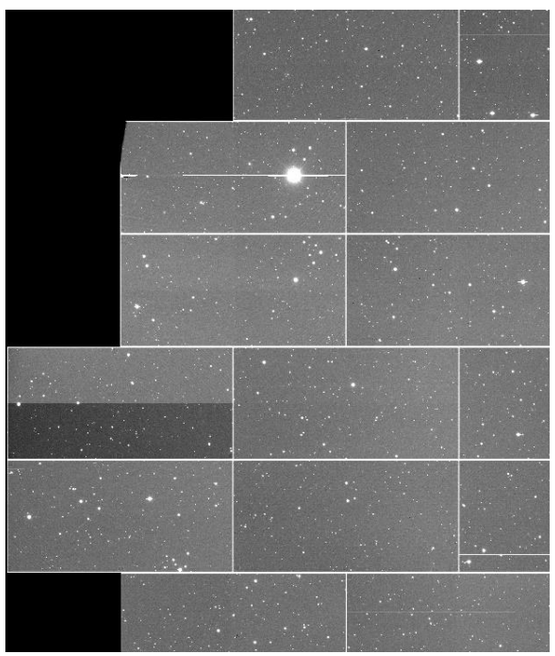
DARK ENERGY SURVEY

- August 30, 2013 < Season 1 < February 10, 2014
- Now DECam is being used by other experiments/projects until DES restarts in August 2014.
- Meanwhile, DES is
  - Working on completion of science publications
  - Preparing the preliminary data release “Y1P1”, due in April
  - Improving DESDM software, hopefully in time for “Y1A1” with “refactored software”
  - Performing maintenance on the camera “DECam” at CTIO



Portion of DECam focal plane w/ scattered light from off-axis star (left).

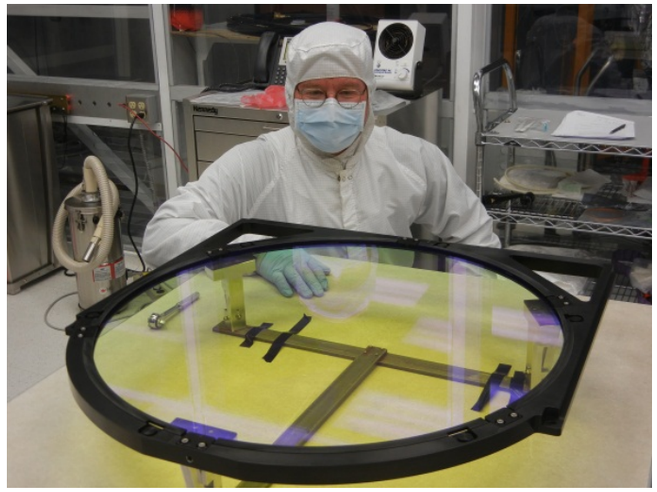
Same field after Z306 paint-job in March 2014 (below)



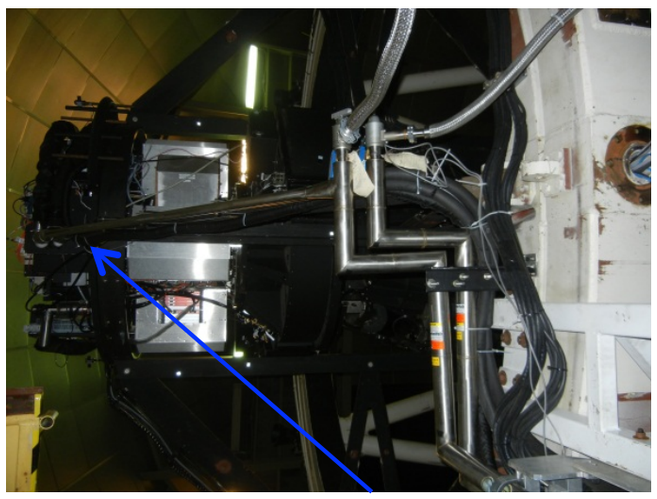
DECam Maintenance

DARK ENERGY SURVEY

- March 11-15, 2014
  - Repaired shutter (replaced a blade motor)
  - Routine maintenance (lube job) on filter-changer
  - Painted reflecting surfaces on shutter and filter-changer with aeroglaze Z306
  - CTIO vr-band filter installed in filter cell
- May 2014
  - Replace LN2 pump (after 7 months)
  - Improve vacuum in LN2 lines that have ice in the superinsulation

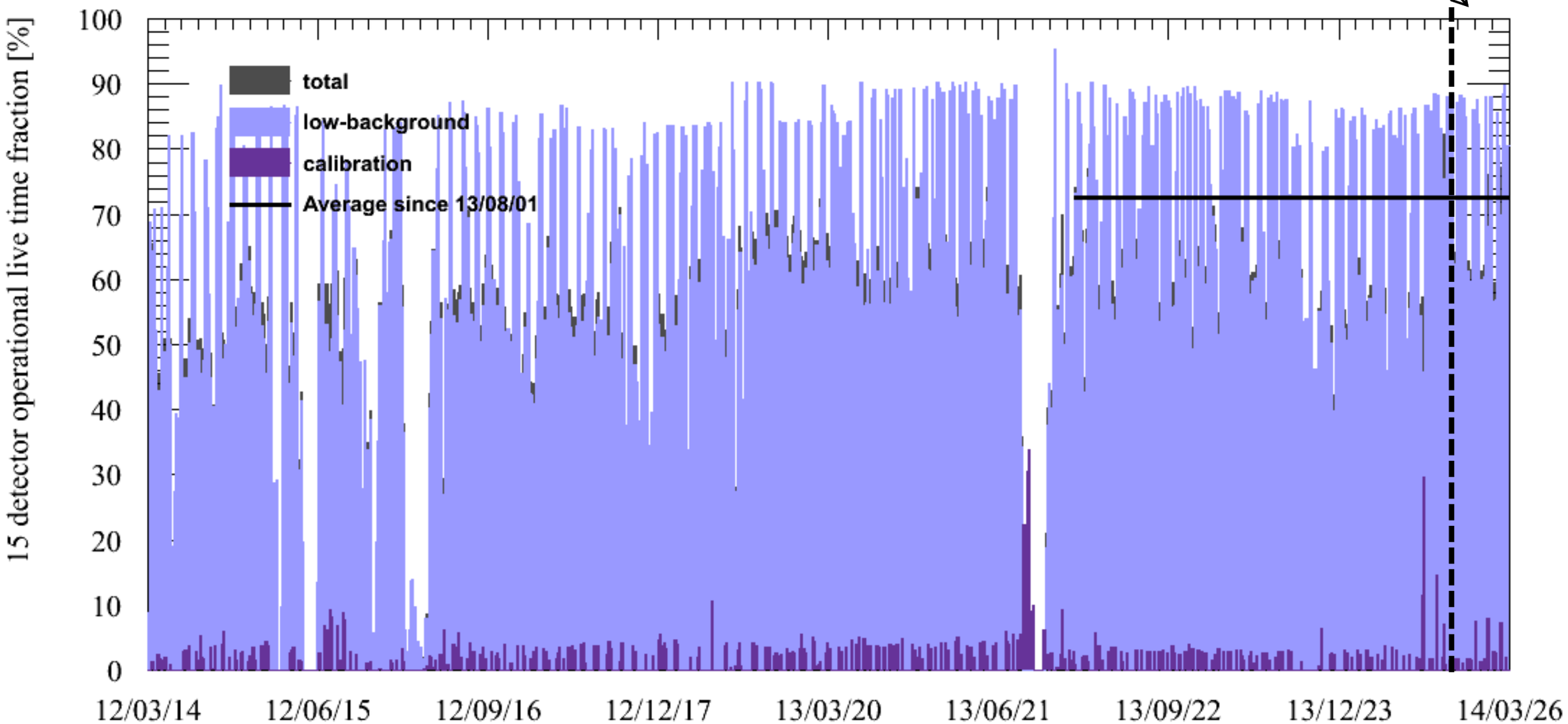


New Paint



Bad vacuum in these lines

SuperCDMS Soudan

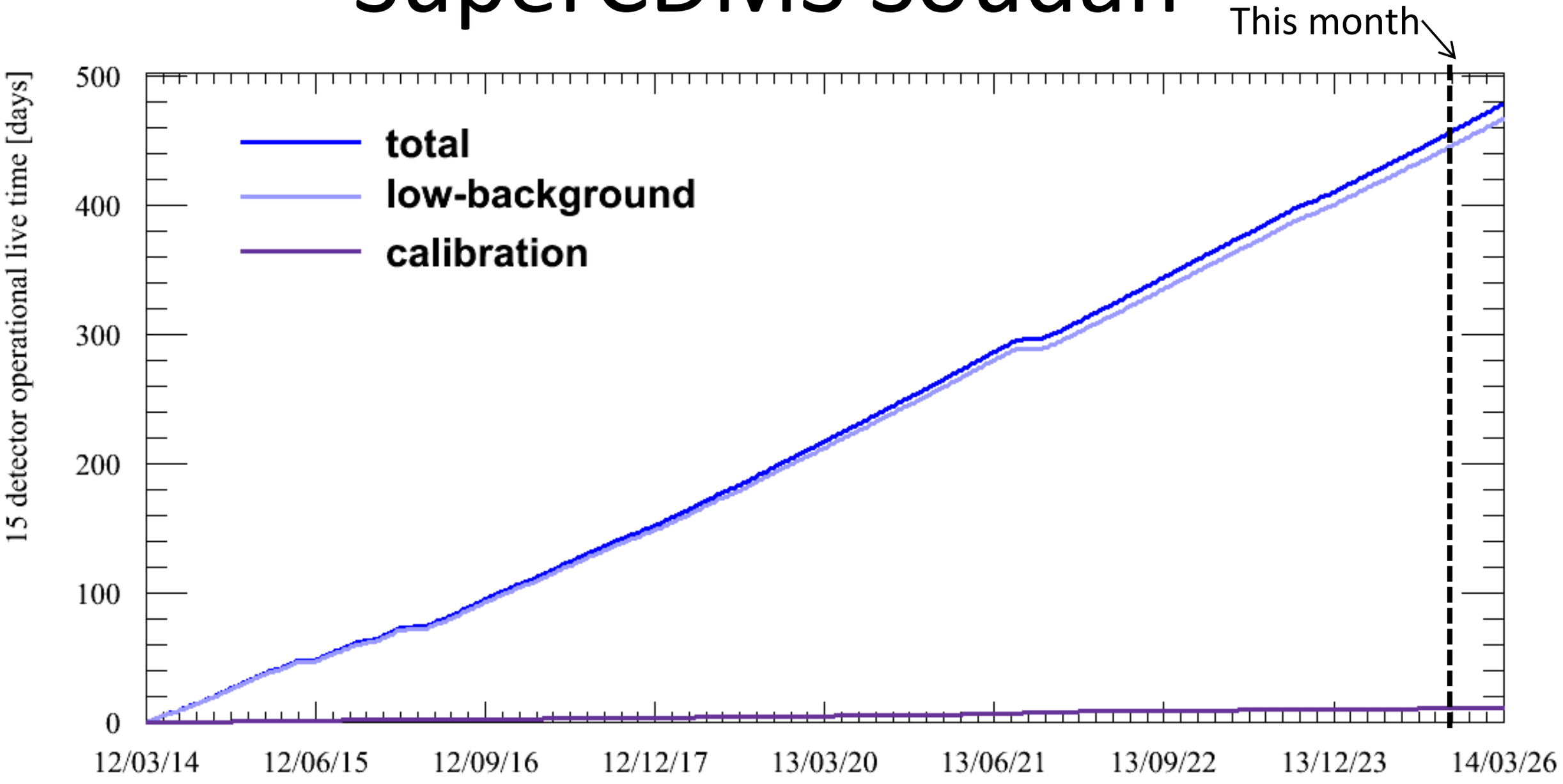


Contributions to the dead-time include:

- 10% due to calibration with gamma and neutron sources
- 10% to maintain detector charge collection
- 5-8% for maintenance and special data sets

Full recovery of all cryogens with reliquefiers minimizes cryo deadtime

SuperCDMS Soudan



Integrated live time (days) since beginning of operations

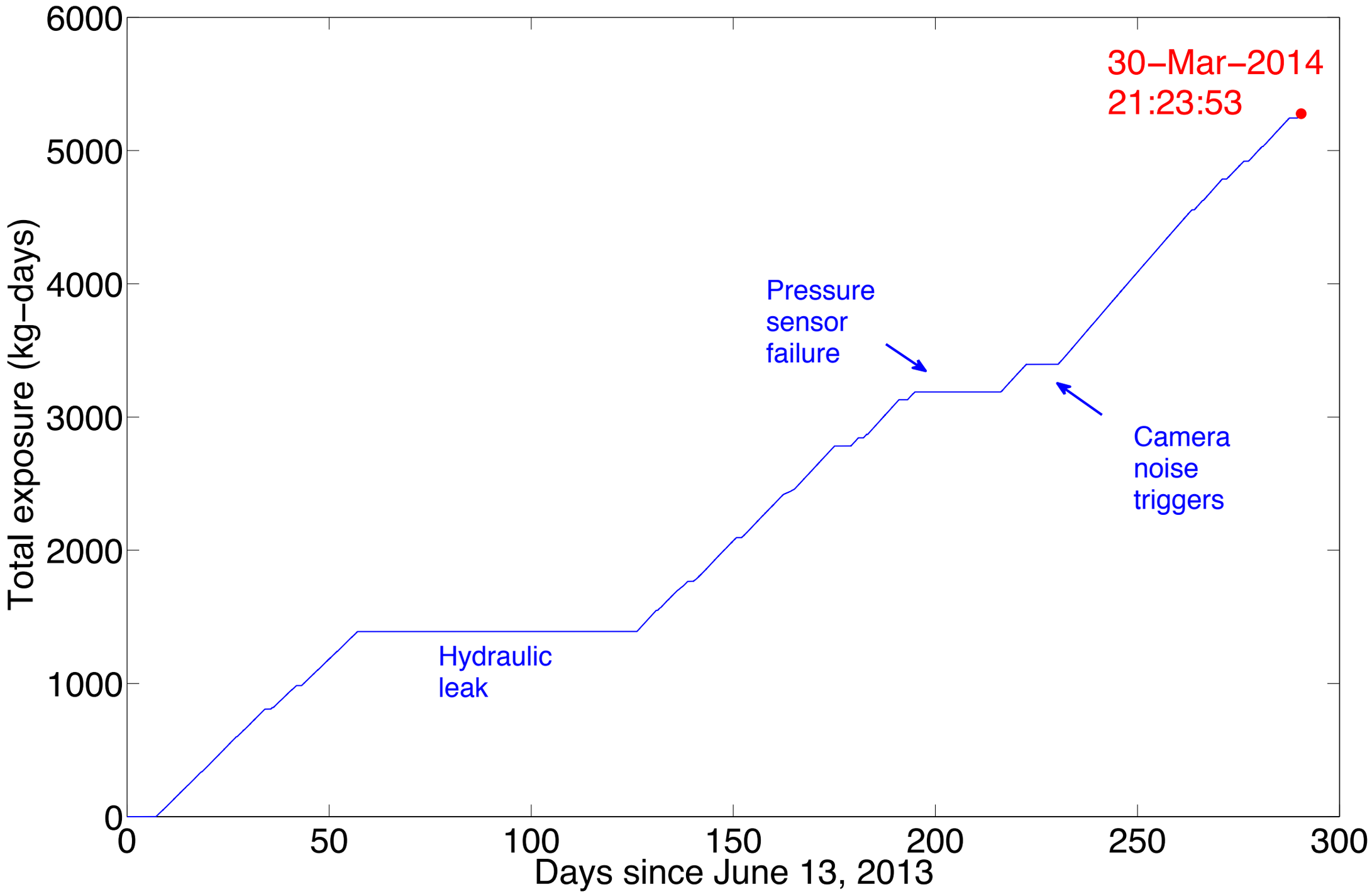
Detector mass is approximately 9 kg Ge, so WIMP exposure =11.6 kg-years

COUPP/PICO Operations Summary

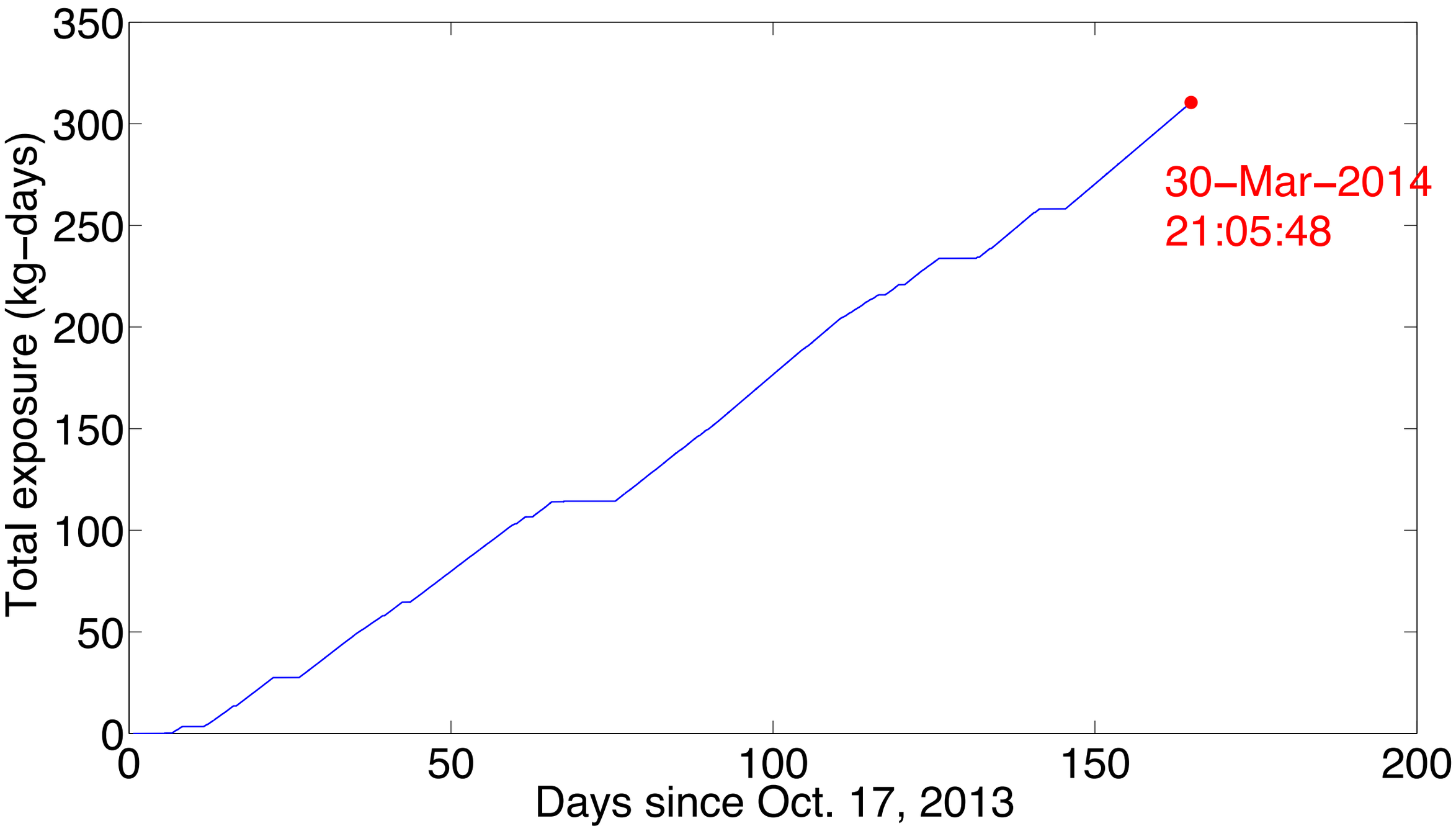
COUPP-60 and PICO-2L runs are continuing both collecting good data

- COUPP60 taking data with temperature gradient imposed by external chiller
  - Trigger change has taken care of camera noise issue (reported last month)
  - Filtering algorithm in off-line analysis removes noisy pixels.
- PICO2L taking data at ~6 keV
  - Analysis shows good discrimination even with only 1 working piezo (failure reported last month).
- Preparations in progress for upgrade to both chambers this summer
  - New filtration system for COUPP60
  - Operational upgrades for PICO-2L

COUPP-60 Exposure Vs. Time



PICO-2L Exposure Vs. Time

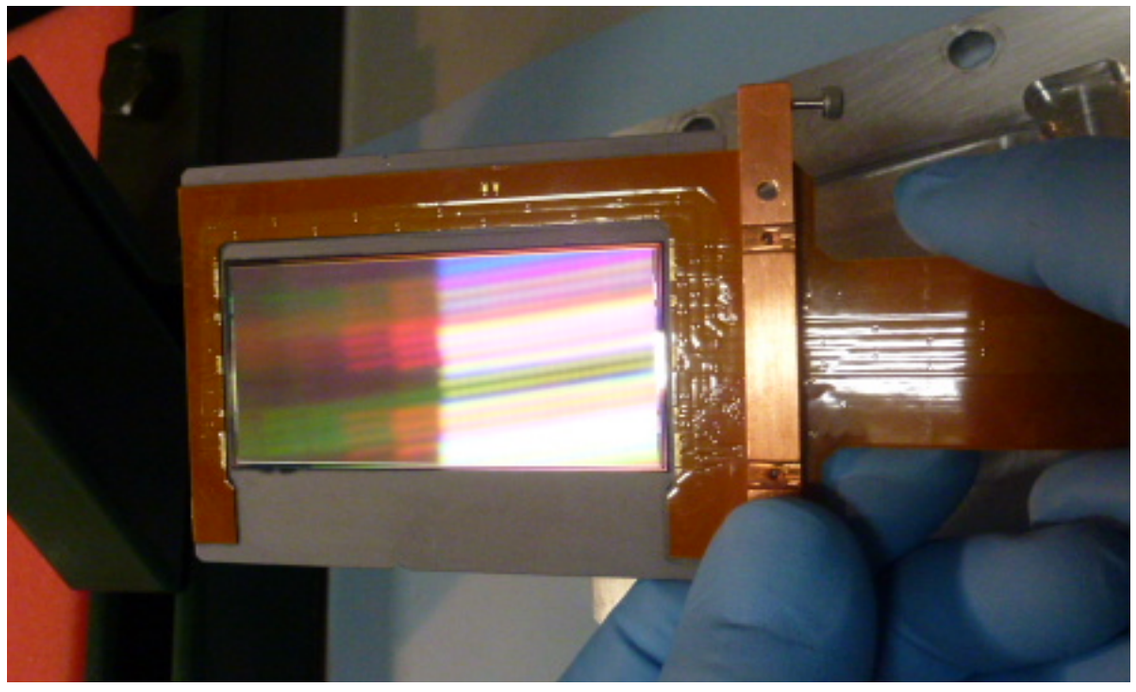


DAMIC – Dark matter with CCDs
(FNAL, UChicago, UMich, Mexico, Argentina, Paraguay, Zurich)

February – March 2014

- Completed the installation of the new prototype ceramic free CCDs modules. **Now taking data**

- Improved the Snolab setup readout noise. **Now below 2e RMS**



Spring 2014

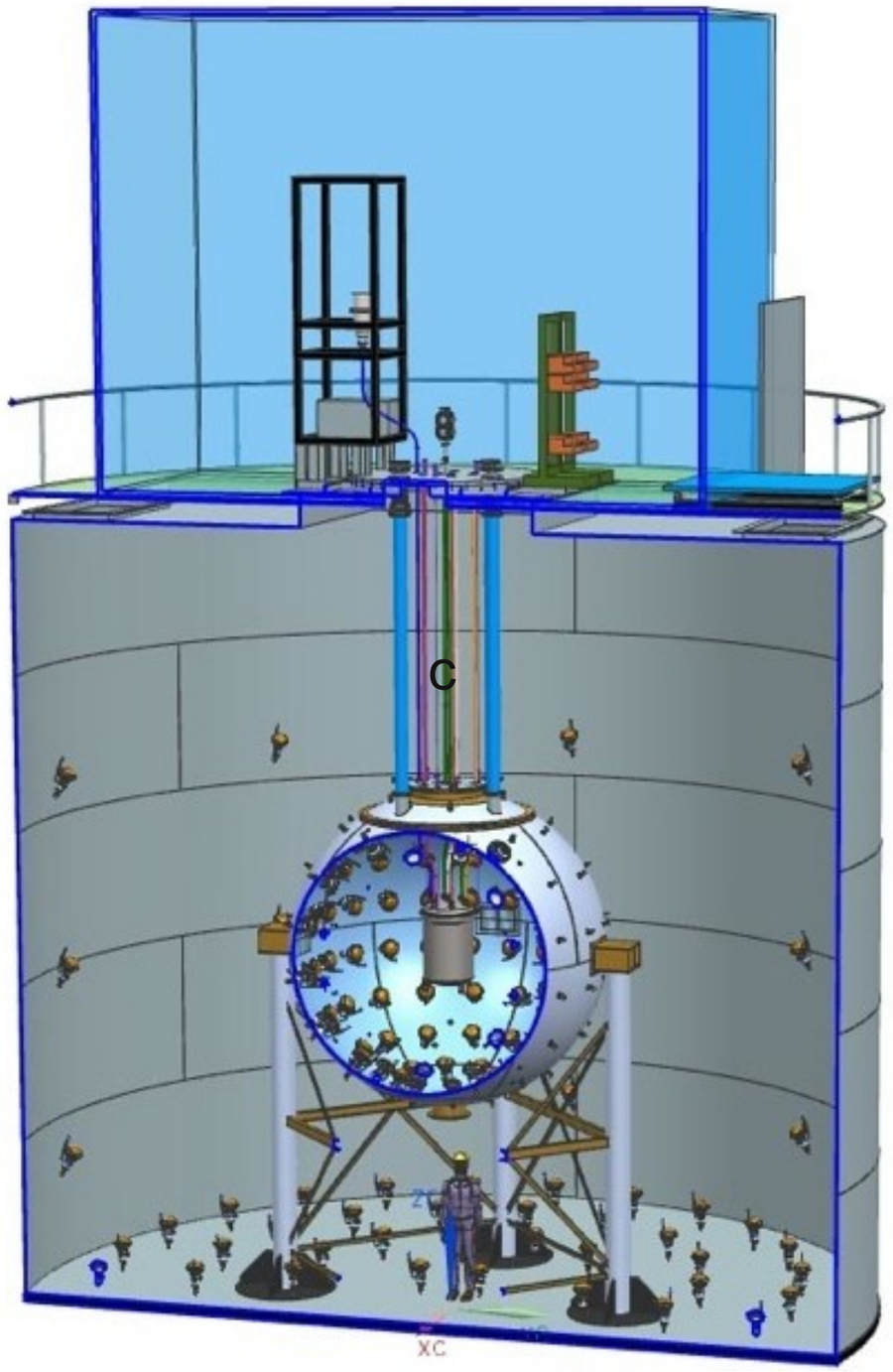
- DAMIC-100 detector order in place for a 100g array [DECam only 70g]
- If prototype packages demonstrate success -> 100g detector in operation during 2014 to probe CoGent/CDMS region… and even lower DM masses.

DarkSide-50 Status

- Detectors Operating

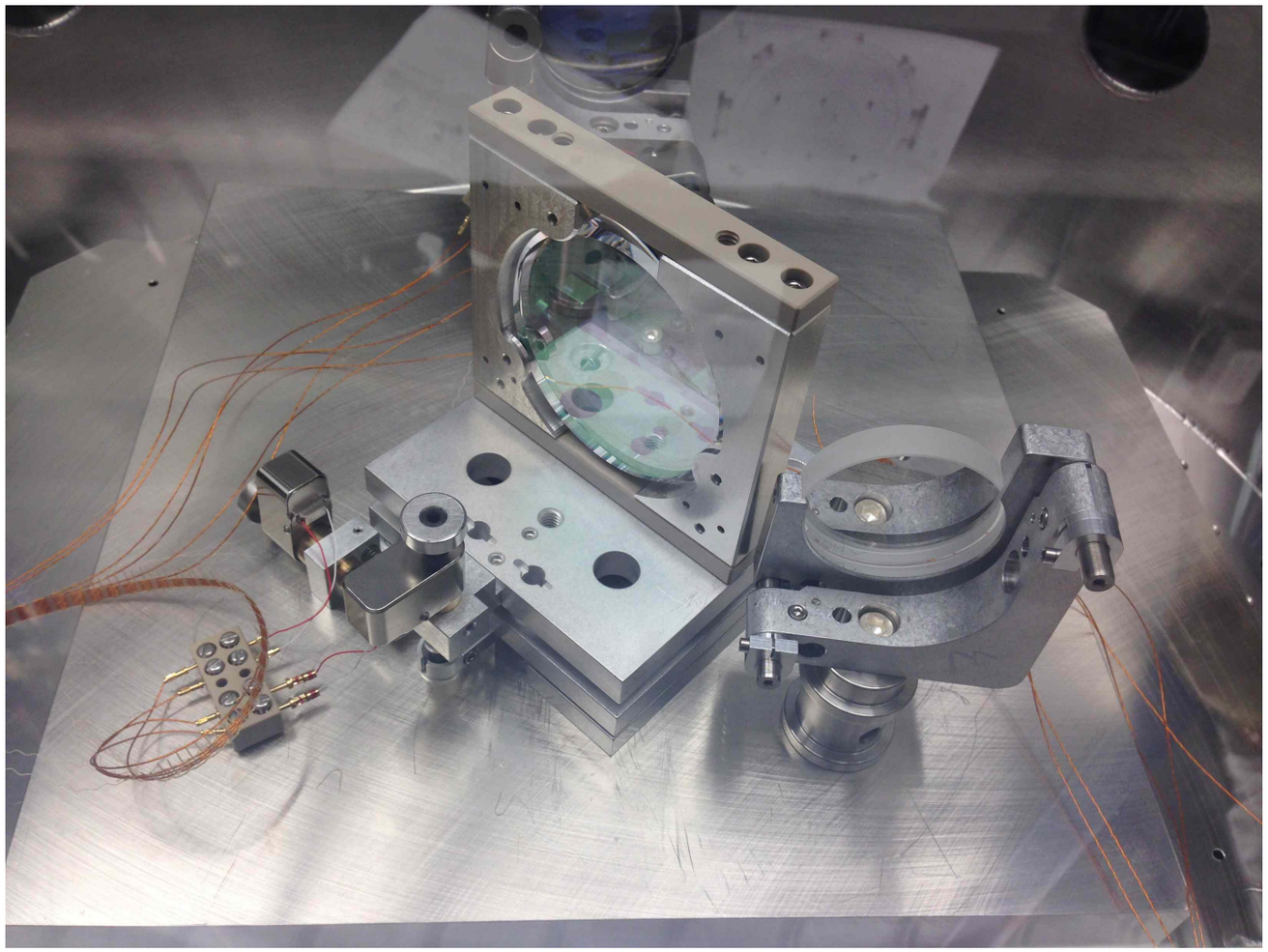
- TPC
  - **Running with Atmospheric Ar**
  - **Demonstration of 39Ar rejection (278 kg - day, equivalent to 2.6yr UAr DS-50) DONE**
  - **Collecting high statistics to prove 39Ar rejection for DS-G2.**
    - **1600 kg – day until March 23rd**
    - **Acquiring at 40 kg- day/day**

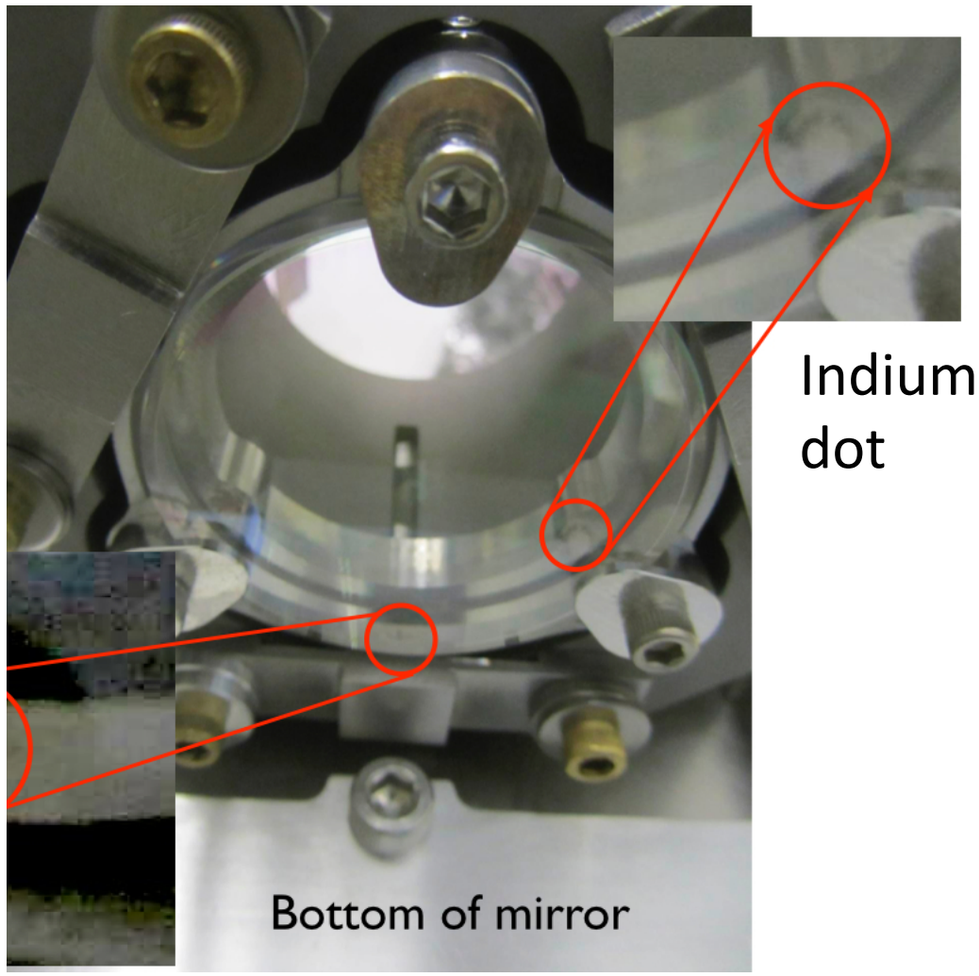
- Neutron Veto
  - **Observed a high ^{14}C rate due to TMB**
  - **Adapting distillation plant to separate PC from TMB and then replace with low ^{14}C TMB – Scheduled to start 04/01/2014**



Holometer (E-990) Commissioning Status:

March 2014: 4 vacuum accesses to improve mounting of various optics.





To fight a new 250 Hz seismic instability in the interferometer control system, the beamsplitter is now installed in an improved UHV vacuum mount with no mechanical resonances between 100 Hz-1kHz. Initial tests indicate successful mitigation of seismic noise.

Previous stress-free, 3-point mounting of end mirrors with indium dots improved matching of beam spot sizes and reduced beam halo by factor of 10 on 1st interferometer. Repeat on 2nd interferometer.